DOCUMENT RESUME

ED 263 416 CE 042 964

TITLE Math on the Job. Teacher's Guide.
INSTITUTION Ohio State Univ., Columbus. National Center for Research in Vocational Education.
SPONS AGENCY Office of Special Education and Rehabilitative Services (ED), Washington, DC.
PUB DATE 85
GRANT G008300003
NOTE 17p.; For the other booklets in this series, see CE 042 963-994.
PUB TYPE Guides - Classroom Use - Guides (For Teachers) (052)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Career Awareness; Career Education; Disabilities; *Emotional Disturbances; Enrichment Activities; Learning Disabilities; *Mathematics Skills; *Mental Retardation; Secondary Education; Skill Development; Special Education; *Work Environment

ABSTRACT

This teacher's guide explains the content and scope of a 30-booklet series of instructional booklets that provide various special needs students with the opportunity to explore a career and practice math skills simultaneously. The introductory section explains the way in which the series, entitled Math on the Job, will benefit high school students with the following disabilities: mental retardation, learning disabilities, and serious emotional disturbances. The second and third sections outline the scope of the series and provide guidelines for its use. Next, a math competency matrix is presented and explained. A list of suggested enrichment activities concludes the guide. (MN)

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MATH on the job

Teacher's Guide

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MATH ON THE JOB:

TEACHER'S GUIDE

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FUNDING INFORMATION

Project Title:	Improving the Basic Math Skills and Job Awareness of Handicapped Students through Simulated Career Exploration Activities
Project Number:	023XH40010
Grant Number:	G008300003
Education Act under Which the Funds Were Administered:	Research in Education of the Handicapped DFDA 84.023X
Source of Grant:	Office of Special Education and Rehabilitative Services U.S. Department of Education Washington, D.C.
Grantee:	The National Center for Research in Vocational Education The Ohio State University 1960 Kenny Road Columbus, Ohio 43210-1090
Executive Director:	Robert E. Taylor
Disclaimer:	This publication was prepared pursuant to a grant from the Office of Special Education and Rehabilitative Services, U.S. Department of Education. Grantees undertaking such projects under Government sponsorship are encouraged to express freely their judgment in professional and technical matters. Points of view or opinions do not, therefore, necessarily represent official U.S. Department of Education position or policy.
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FOREWORD

Many handicapped students experience difficulty in entering the labor market. In many cases, they leave high school without a reasonable knowledge of the world of work, a clear understanding of self in relationship to potential occupational pursuits, or a mastery of the basic skills required to function in different occupational roles. To assist students in this transition from school to work and to reinforce basic skills education, the National Center has developed and evaluated a set of instructional materials entitled MATH ON THE JOB.

These materials will help mentally retarded, learning disabled, and seriously emotionally disturbed high school students acquire information regarding thirty entry-level occupations. The students will discover how various math concepts and skills are used in the occupations, apply different math skills in the performance of selected occupational tasks, and consider the educational and training requirements for preferred occupations.

This project was a broadly based effort incorporating many agencies and individuals. We are particularly indebted to the following individuals for their participation in the pilot and field tests: Mr. James Baker, Career Education Coordinator, Special School District of St. Louis County, Town and Country, Missouri; Mr. Philip Beckwith, Vocational Education Consultant, School District of Greenville County, Greenville, South Carolina; Ms. Barbara Cornett, Director of Special Education, Salinas Union High School District, Salinas, California; Mr. Bob Sullivan, Program Administrator, Milwaukee City Schools, Milwaukee, Wisconsin; and their teaching staffs.

We also appreciate the consulting expertise of Dr. Janet Lerner, Chairperson and Professor, Department of Special Education, Northeastern Illinois University; Dr. Jeffrey Messer, Professor, Department of Special Education, Northeastern Illinois University; Dr. Charles Kokaska, Professor, Department of Educational Psychology, California State University at Long Beach; and Ms. Jane Razeghi, Project Director, American Coalition of Citizens with Disabilities for their assistance in selecting the thirty occupations, review of the prototype booklets, and Product Review Evaluations.

This project was conducted in the Development Division of the National Center. We wish to thank Dr. Valija Axelrod, Project Director, Ms. Roxi Liming and Mr. George Merryman, Program Assistants, for their development of the materials, Ms. Jennifer Cummings, Program Associate, for writing the teacher's guide, Dr. Jim Weber and Dr. Dick Miguel, Research Specialists for data analysis, and Dr. Shirley Chase and Ms. Nancy Puleo for internal Product Review Evaluations. Special appreciation is given also to Dr. Lorella McKinney who provided the initial conceptualization to the effort and provided project leadership during the first two years of the contract cycle.

We appreciate the skills of Ms. Barbara Hainon, Ms. Debbie Fladen, and Ms. Marilyn Willhoff for typing and word processing support. Graphics were provided by Mr. Jaime Lombardo and Ms. Sue Dziura. Ms. Judy Boylson laid out and assembled the booklets.

The funds for this project were provided by the Office of Special Education and Rehabilitation Services, U.S. Department of Education.

Robert E. Taylor
Executive Director
The National Center for Research
in Vocational Education

INTRODUCTION

Teaching is a process that requires different approaches for different students. The MATH ON THE JOB series is a new approach that incorporates occupational exploration with basic math skill building for those high school students with special needs. This series consists of thirty (30) booklets that provide these students an opportunity to explore careers and practice math skills simultaneously.

Each booklet--

- Focuses upon an occupation for which the relative number of potential openings is large and does not require a college degree for entry.
- Helps students learn how basic math skills are used by workers on the job.
- Presents information at a reading level that is as low as possible while still conveying concepts that are relevant to adolescents and adults.
- Motivates students to solve occupationally-specific math problems.
- Supplements and reinforces classroom learning.
- Focuses upon an occupation that students can experience in general or vocational education classrooms in a typical high school.
- Provides students the opportunity to practice math-related applications in a sequenced series of problems.
- Contains four different math applications relevant to the occupation. Each math application--
  - provides clear and detailed instructions
  - ensures ample opportunity for repetition, practice, feedback, and reinforcement.
- Contains an average of 45 math problems and provides information on--
  - what the worker does
  - where the worker works
  - how the worker uses math
  - what things the worker needs to know
  - what courses, training, and experience the worker needs to enter the occupation

SCOPE OF MATH ON THE JOB

In this series of 30 booklets, high school students with special needs will learn that mathematics skills and knowledge have value on the job every day. Each booklet focuses on one of the following occupations:

- Accounting clerk/bookkeeper
- Barber/cosmetologist
- Carpenter
- Cashier
- Combination welder
- Computer service technician
- Construction laborer
- Cook
- Electrician
- Grain farmer
- Heavy equipment operator
- Janitor/maintenance person
- Local truck driver
- Machinist
- Maintenance mechanic
- Meat cutter
- Metal product assembler
- Motor-vehicle mechanic
- Nurse aide/assistant
- Painter
- Plumber
- Programmer
- Radio/TV service person
- Receiving clerk
- Sales clerk
- Secretary/clerk-typist
- Sheet-metal worker
- Taxi driver
- Tractor-trailer driver
- Waiter/waitress

The instructional objectives of MATH ON THE JOB are--

- to help students acquire information about selected entry-level occupations (i.e., occupations for which training is generally provided at the secondary level);

- to help students discover how different workers use basic math skills on the job every day;

- to help students realize that the basic math skills taught at the secondary level are fundamental to the performance of many jobs;

- to provide students with an opportunity to perform occupational tasks that require the application of basic math skills;

- to help students become more familiar with the entry requirements for the occupations addressed; and

- to provide students with an opportunity to consider the future education and training requirements for preferred occupations.

USE OF MATH ON THE JOB

Each occupational booklet is designed to focus student attention on a particular job and the basic math skills required to satisfactorily perform that job. While using the materials, students are given the opportunity to function for a short period of time in a situation that illustrates a real, on-the-job, application of a set of mathematics skills being mastered in the classroom.

Students select specific booklets on the occupations of greatest interest. Once specific occupational booklets have been chosen, the students proceed with teacher assistance provided on an individual, as needed basis. First, the student reads the background information about the occupation and how math is used on the job. Then, the student works on a series of job-related math practice problems.

After completing the first series of math problems, the student reads information about the work environment. At this point, if the student is no longer interested in the occupation and has mastered all the math skills, the student can proceed to another booklet. If the student is interested in the occupation or desires additional math practice, the student proceeds with the remainder of the booklet which includes more information on the occupation and additional practice problems.

MATH ON THE JOB allows the teacher to be a facilitator of learning. Students should be encouraged to take responsibility for managing their own learning experiences. The students' questions should be answered and the teacher should give help in a manner that maintains student responsibility for learning.

While MATH ON THE JOB is designed to improve and reinforce basic math skills, these booklets also will assist students in exploring a variety of careers. Teachers and guidance counselors may want to use these booklets to help students make career choices. If a student is interested in several different careers, the teacher or guidance counselor may assign the appropriate booklets to the student. After completing the exercises in the booklets, students may gain further interest in that or a related career.

Many students have difficulty in applying knowledge learned in a classroom to other area of their lives. MATH ON THE JOB will demonstrate to students the relevancy of classroom instruction. These booklets can serve as a basis for classroom discussion regarding how basic math skills are used in various aspects of everyday life and how other basic skills are used by workers on the job.

MATH COMPETENCY MATRIX

The basic mathematics competencies required on the job by workers in the thirty selected occupations vary; however, most jobs require at a minimum the ability to--

- read, write, count, add, subtract, multiply, divide, round off, and solve word problems with whole numbers
- read, write, add, subtract, and solve word problems with dollars and cents
- read graduated scales
- estimate and measure in standard units, including time, weight, and distance
- read, write and perform some operations with fractions
- calculate percentages

A matrix detailing the mathematics competencies required in each occupation is shown on the next page. This matrix lists the thirty occupations in alphabetical order, with an "X" placed in the corresponding math competency column. This matrix is adapted from the work of Smith (1975). Definitions used in the matrix are as follows;

Whole numbers -- read, write, count, add, subtract, multiply, divide, round off, word problems.

Fractions -- read, write, add, subtract, multiply, divide, word problems.

Decimals -- dollars and cents, read, write, round off, multiply, divide, add, subtract, word problems.

Equivalents -- change fractions to decimals or percentages; change decimals or percentages to fractions; change decimals to percentages or vice versa.

Ratio and proportion -- use ratio to show comparisons between two numbers. Use proportion to solve problems like 4:6 = 3:(?).

Smith, Arthur, Generic Skills: Research and Development. Prince Albert, Saskatchewan, Canada: Training and Development Station, 1975.

BASIC MATHEMATICS USED BY
WORKERS IN THIRTY OCCUPATIONS

Occupation	Whole Numbers	Fractions	Decimals	Percentage	Equivalents	Average	Ratio Proportion	Graduated Scales	Tables, Charts, Graphs & Drawings	Scale Drawings	Measurement	Estimation
1. Accounting clerk/bookkeeper	X	X	X	X	X	X	X	X	X			X
2. Barber/cosmetologist	X	Read/write	X	X	X		Ratio				T,V,C,	X
3. Carpenter	X	X	Dollars/cents			X		X	X	X	D,C,An,P,Ar,V	X
4. Cashier	X	X	Dollars/cents	X				X			T	
5. Combination welder	X	X	Dollars/cents	Read/write			Ratio	X	X	Read/measure from	D,An,P,Ar,V	
6. Computer service technician	X	X	X	X	X	X	X	X	X	Read	T,D,C,An,P,Ar	X
7. Construction laborer	X	X	Dollars/cents					X			T,D,An,Ar	X
8. Cook	X	X	X	X	X	X	X	X	X		T,M,C,Q,V	X
9. Electrician	X	X	X	X	X	X	X	X	X	X	T,D,C,An,P,Ar,V	X
10. Grain farmer	X	X	X	X		X	Ratio	X	X	Read/measure from	T,M,D,C,An,P,Ar,V	
11. Heavy equipment operator	X	Read/write	Read/write					X	X	Read	D	X
12. Janitor/maintenance person	X	Read/write		X			Ratio	X			T,C,An,Ar	X
13. Local truck driver	X		Dollars/cents					X			T,D	X
14. Machinist	X	X	X	Read/write	X	X		X	X	X	T,M,C,An,Ar	X
15. Maintenance mechanic	X	X	X	X	X	X	Ratio	X	X	X	T,M,D,An,P,Ar	X
16. Meatcutter	X	X	X	X	X		Ratio	X	X		T,M,C,Q,An	X
17. Metal product assembler	X	X	X	X	X	X		X	X	Read/measure from	T,An	X
18. Motor vehicle mechanic	X	X	X	X	X	X	X	X	X	Read	T,M,D,C,An,V	X
19. Nurse aide/assistant	X	Read/write	Dollars/cents	Read/write				X	X	X	T,M,C	X
20. Painter	X	Read/write		X			X	X		Read/measure from	T,D,C,An,P,Ar,V	X
21. Plumber	X	X	X	X	X	X	X	X	X	X	T,D,C,P,Ar,V	X
22. Programmer	X	X	X	X	X	X	X	X	X	Read	T,D,Q,An,P	X
23. Radio/TV service person	X	X	X	X	X	X	X	X	X	Read	T,D,C,An,P,Ar	X
24. Receiving Clerk	X	X	X	X		X						
25. Sales clerk	X	X	Dollars/cents	X		X		X				
26. Secretary/clerk typist	X	X	X	Read/write		X		X	X		T,M,Q	X
27. Sheet-metal worker	X	X	X	X	X	X	Ratio	X	X	X	T,M,D,C,An,P,Ar,V	X
28. Taxi driver	X		Dollars/cents					X			T,D	X
29. Tractor-trailer driver	X	X	X	X			Ratio		X	Read	T,M,D,C,Ar,V	X
30. Waiter/waitress	X	X	X	X							C	X

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Graduated scales -- such as postage meters, weight scales, thermometers, micrometers, etc.

Tables -- read to perform conversions, to determine tax, etc.; charts -- read to determine price, etc.; graphs -- read, record information, and construct.

Scale drawings -- read, measure from, and draw.

A key to the measurement codes used within the matrix are as follows:

Measurement	Code
Time	T
Weight	W
Distance	D
Capacity	C
Quantity	Q
Angles	An
Perimeters	P
Areas	Ar
Volumes	V

ENRICHMENT ACTIVITIES

The following activities could be used to enhance and broaden the students' experience.

- Assist students in exploring other occupations such as Hotel/Motel Managers, Purchasing Agents, etc. Once students have identified other occupational areas, ask them to identify relevant math concepts for those occupations.

- Stage a MATH ON THE JOB fair. Invite parents or friends of students to visit your classroom to explain how math is used on their jobs.

- Simulate actual work in realistic situations. (e.g., students interested in becoming cooks could actually prepare food in the home economics department).

- Arrange field trips to work sites for groups of students with similar job interests.

- Display materials, tools, and equipment that workers actually use on the job. These could be borrowed from the vocational education department.

- Invite vocational eduation instructors to discuss programs related to jobs included in MATH ON THE JOB.

- Schedule students to visit vocational education classes to observe and talk with students.

Most teachers will be able to expand upon this list by drawing on the resources of the school and the community.